and, consequently, the $\triangle MNO=\frac{1}{8}(\mathbf{N})^2 / \sin A \sin B \sin C \ldots (5)$. The expression for the average area of the $\triangle MNO$, therefore, becomes

$$\mathbf{A}=\frac{1}{8abc \sin A \sin B \sin C}\int_0^a\int_0^b\int_0^c (\mathbf{N})^2 dxdydz$$

$$=\tfrac{1}{24}\left(\frac{a^2 \sin A}{\sin B \sin C}+\frac{b^2 \sin B}{\sin C \sin A}+\frac{c^2 \sin C}{\sin A \sin B}\right)=\frac{a^4+b^4+c^4}{48\triangle}.$$

[Note.—Problems twenty-three and twenty-four are identical. This fact was not observed until after they were both printed. Ed.]

PROBLEMS.

31. **Proposed by B. F. FINKEL, A. M., Professor of Mathematics and Physics in Drury College, Springfield, Missouri.**

Find the average length of a line drawn at random across the opposite sides of a rectangle whose length is l and breadth b.

32. **Proposed by F. P. MATZ, M. Sc., Ph. D., Professor of Mathematics and Astronomy in Irving College, Mechanicsburg, Pennsylvania.**

Find the average area of the random sector whose vertex is a random point in a given circle.

MISCELLANEOUS.

Conducted by J. M. COLAW, Monterey, Va. All contributions to this department should be sent to him.

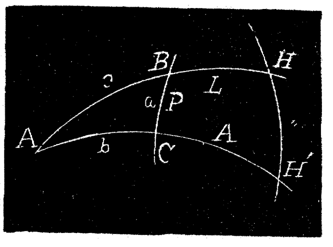
SOLUTIONS OF PROBLEMS.

17. **Proposed by SAMUEL HART WRIGHT, M. D., M. A., Ph. D. Penn Yan, New York.**

A bright star passed my meridian at 7 P. M. The Chronometer soon after ran down and stopped, but I set it again when the same star had a true altitude of $30^\circ=\alpha$. What time was it then, my latitude being $42^\circ\ 30'$ N.$=\lambda$, and the star's declination 60° N.?$=\delta$

II. **Solution by the PROPOSER.**

Let B be the north pole, A the zenith, C the star, HH' the horizon, AH and AH' each $=90^\circ$, AH' being a meridian, AH a verticle circle, BH' the altitude of the pole = the latitude $=L$, $AB=$co-latitude $=c$, $BC=a=$ polar distance of the star$=P$, $AC=b=$the zenith distance of star, $CH=A=$altitude of the star, and the angle $ABC=$the hour-angle of the star$=T$ in siderial time. Put $s=\frac{1}{2}(a+b+c)$, and $s-a=a'$, $s-b=b'$, and $s-c=c'$. Then by *Sph. Trig.*



$\sin \frac{1}{2}T=\sqrt{\left(\frac{\sin c' \sin a'}{\sin c \sin a}\right)}$, and